

dated eggs are always few in number. Nevertheless they arrive at the blastula stage, or sometimes the gastrula with a shallow invagination.

*Strongylocentrotus* ♂ and *Sphærechinus* ♀.—The larvæ do not pass the blastula stage.

*Id.* and *Psammechinus* ♀.—Plutei normally and perfectly developed.

*Id.* and *Spatangus* ♀.—All the ova become regularly segmented. I have never seen them attain the Pluteus stage; they do not pass the stage of perfect gastrula, with a gastric cavity and calcareous spicules on each side of the mouth.

*Psammechinus* ♀ and *Sphærechinus* ♂.—The larvæ always stopped at the gastrula stage, with the gastric invagination not deep.

*Id.* and *Dorocidaris* ♂.—No appearance of segmentation. (The same observation applies to both *Dorocidaris* and *Strongylocentrotus*.)

*Id.* and *Spatangus* ♂.—A few ova were segmented and attained the blastula stage.

*Psammechinus* ♂ and *Spatangus* ♀.—In all the experiments all the ova attained the stage of Plutei, and these lived for several days. The development takes place comparatively very slowly; thus, the hybrid larvæ are still in the gastrula state when the larvæ, obtained by direct fecundation under the same conditions, have attained the Pluteus stage a day or two. Moreover the form of the Pluteus presents some peculiarities; the arms are shorter and stouter, and the contours are less regular than in the normal Plutei of *Spatangus*; the calcareous skeleton also presents differences. Even in the gastrula we observe peculiar characters, the pigmentation being much less abundant in the gastrulæ produced by crossed fecundations.

*Psammechinus* ♂ and *Sphærechinus* ♀.—A small number of ova become segmented, but do not pass the blastula stage.

Crossed fecundations therefore are possible between different species of Echinoidea, and that between very wide limits. There is certainly at least as much difference between a *Spatangus* and a *Psammechinus* as between two mammals belonging to two allied orders. And if the Plutei obtained by crossing between regular Echinoids do not appear to differ much from the legitimate Plutei of the type functioning as female in the experiments, there are certainly well marked differences between a legitimate Pluteus of *Spatangus* and a hybrid Pluteus of *Spatangus* and *Psammechinus*.

I must, in conclusion, call attention to one fact:—Because the ova of a species when fecundated by the spermatozooids of another species arrive at the state of Pluteus, it does not follow that the converse is true. Thus the ovules of *Spatangus* are perfectly fecundated by the spermatozooids of *Psammechinus*; but the ovules of the latter, subjected to the influence of the semen of *Spatangus*, remain for the most part intact, while the rest scarcely reach the blastula stage.—*Comptes Rendus*, April 24, 1882, p. 1203.

*On Variation in the Nest-forms of the Furrow-Spider (Epeira strix).* By the Rev. Dr. H. C. McCook.

The author had observed that some of the orb-weaving spiders have a marked tendency to vary the forms of their nests. The

spinning-work of spiders may be classified as (1) the *snare*, spun for the capture of prey; (2) the *enswathment*, by which insects are disarmed and prepared for food; (3) the *gossamer*, used for purposes of aqueous or aerial locomotion; (4) the *cocoon*, spun for the propagation and protection of the species; and (5) the *nest*, which is a domicile more or less elaborate and permanent, within or under which the araneid dwells for protection against enemies and weather-changes. As a rule the great groups of Orb-weavers differ from each other and agree within themselves in the characteristic form of nest. The form prevailing in each family is substantially the same; each species appears to adhere quite steadily to one characteristic form; but there are some marked variations in the habit of certain species, the most decided of which have been observed in the case of *Epeira strix*. Some examples of this were given.

1. The ordinary nest of *E. strix* when domiciled in the open field or wood is a rolled leaf. A single leaf is taken, the edge pulled up, drawn under, and fastened by adhesive threads into a rude cylinder, within which the spider hides during the daytime. A thread-connexion with the foundation-lines of the snare is maintained; but rarely with the centre of the orb by a taut trap-line, as is the habit of the insular spider, *Epeira insularis*.

2. A second form of nest varies from the rolled-leaf nest in having the edges of two adjacent leaves bent towards each other and lashed together on the exterior at the juncture by silken cords and on the interior by adhesive-tissue web. An oval opening is left at the united points of the leaves, through which the connecting-line passes to the snare. The spider domiciles within the leafy cavern thus formed.

3. Again, the spider avails herself of small holes in wood or stone, openings in fences, the interspace between curled bark on the trunk of old trees, or some like cavity, which she appropriates as a nesting-place. A slight lining will generally be found upon the concave surface. Dr. McCook had noticed that in such cases the snare is sometimes diverted from its normal shape in order to give a convenient approach thereto from the den. One such example was found spun between a side of the Peace Fountain in Fairmount Park (Philadelphia) and the stone wall adjoining. In order to pitch her tent within a hole in the rock, the spider diverted one of the radii from the plane of the orb, and extended it backward to the hole. The spirals which passed over this radius thus made an elbow or angle, which was indeed nearly a right angle, and gave the orb an odd broken appearance. The radius of course served as the bridge-line by which the spider passed from her den to her snare.

4. Another variation was due to an accident in the environment of the web. A half-grown *E. strix* had woven a snare in the hollow of a decayed tree (at New Lisbon, Ohio), within two feet of the ground. A colony of the Pennsylvania carpenter-ant (*Camponotus pennsylvanicus*) had quarters in the tree; and a squad of black workers were busy excavating their wooden galleries. These dropped their chippings from openings just above the spider's orb, whose viscid spirals retained goodly quantities of the brown sawdust. In course of time a ball of chippings as big as a walnut had accumulated, or,

perhaps, had been purposely massed by the spider. However that may be, the ball was utilized as a nest; its centre had been pierced, a spherical cavity formed by silk-lining the interior, which was entered by a circular door bound around the edge by spinning-work. This quaint domicile was pendent from one of the strong upper foundation-lines; and herein the spider rested, while the emmet carpenters worked away above her, and continually dropped chips upon the roof of her den, and the orb beneath, until one side of the snare was quite covered with them. In this case the position of the nest, as well as its form, was exceptional, as the nest-site of *E. strix* is well nigh invariably beyond the limits of the web, sometimes, indeed, several feet. In these points the spider was evidently led to an intelligent variation of her nest-building by circumstances.

5. Another variation, or rather a series of variations, was noted upon the side of Brush Mountain, at Bellwood, Pennsylvania. Several young pine trees had been cut away and tossed from the mountain to the banks of the Juniata river below. The foliage had withered and fallen from the boughs, whose branches stretched out dry and bare; and among them a colony of young furrow-spiders had pitched their tents and spread their snares. One specimen happened to spin her web near the axil of several goodly sized branches, which were formed into a natural shelter by the inverted position of the bough. The spider had recognized this vantage, and made her nest at the point of junction, or rather took shelter there, for there was very little artificial nesting beyond a faint tissue spread over the bark at the point where she sat.

A second specimen had lodged at a point near the tip of a small branch whose delicate dry twigs gave no sufficient shelter, and, besides, were directed upward. Accordingly a silken tube, funnel-shaped, was spun between the twigs, within which the young spider nested.

A third spider, lodged in a similar site, had made a silken sack for a tent, whose mouth had apparently originally opened directly towards the snare. But a saltigrade spider had fastened a parasitic tubular nest upon one side of this sack; and accordingly the mouth was found closed and the door shifted to the opposite side, as though to avoid interference with a troublesome neighbour.

A fourth individual had woven a simple silken cover or screen, behind which she lodged. A fifth had pitched her tent upon a stray leaf, beneath which a similar cover, a small rectangular piece of silk canvas (suggestive of the military bivouac or "dog tent") was stretched by lines attached to the sides and corners, and fastened to the leaf-surfaces and surroundings. Between this sheet and the leaf the spider was ensconced, having the usual bridge-line connexion with the orb.

6. Two of the above colony had established nests in tufts of a parasitic moss fastened upon the dead limbs. One of these was very pretty and ingenious. The moss grew in a bunch about the size of a hickory-nut; this was pierced at the top, and the filaments pushed aside sufficiently to allow an interior cavity large enough to house a spider. An oval door or opening was formed near the top by bending and binding back the fibres of the plant. A secure and

tasteful retreat was thus obtained at the only really available spot in the vicinity of the snare.

7. When the furrow-spider weaves her orb upon the exposed surfaces of human habitations, as the cornices of porches, outhouses, &c., her nest takes a form quite different from any of the above. A tube of stiff silken fibre is spun against the surface, to which it is lashed at all sides. This cylinder is about an inch long and half an inch thick, and, at the end towards the orb, has a circular opening about a quarter of an inch in diameter. The stiff texture of the nest appears to be necessary to make the walls self-supporting, inasmuch as there are no supporters like the twigs and leaves found at hand in arboreal sites. Moreover the open position of the domicile exposes the spider very freely to the assaults of the mud-daubers who frequent such localities, to birds, and other enemies; so that a canvas is needed of tougher texture than that required in sheltered sites. It may be remarked that in old buildings, which present cracks and crannies convenient for nesting, woven nests of this sort will rarely be found.

It is thus seen that while there is a general regard to protection of the spider's person, there is a modification over a quite wide degree of variation in the form of the protective nest; further, that this modification appears to be regulated, more or less, by the accidental environment of the domicile, and in such wise as to show no small degree of intelligence in adapting the ordinary spinning habit to various circumstances, and to economizing labour and material.—*Proc. Acad. Nat. Sci. Philad.* March 21, 1882, p. 97.

*On Segmentation in the Mites.* By P. KRAMER.

After referring to some previous publications of his own and of other writers on this subject, the author describes, as follows, the segmentation of a minute mite found by him on the ground in a fir-plantation in the Thüringer Wald, and which he identifies with *Alycus roseus* of Koch. He says:—

“The dorsal aspect shows a very distinct segmental line between thorax and abdomen. The shoulders of the latter project rather convexly; and between them the segmental line is slightly sinuated posteriorly. The abdomen shows nine distinct segments, which follow one another exactly as we see them in the little *Poduræ*. The segmental grooves between the first three abdominal segments are broad, and present, to a certain extent, the appearance of double lines, of which the anterior cut off the preceding segment, and the posterior commence the succeeding one. The lateral margin of the abdomen shows distinctly the convexities and constrictions which correspond to the middles and the boundaries of the segments. The setation throughout follows the segmental conditions; there are rows of setæ upon the surfaces of the segments, only running parallel to the boundary-lines of the segments. The hindmost segment bears the perfectly terminal anal aperture, half of which is seen in the dorsal view, while the other half is seen in the ventral aspect.

“On the thorax there is a distinct pair of eyes, furnished with